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INDUSTRIAL ADVISORY SERVICES AND TRAINING

DP/JOR/87/009

JORDAN

Technical report: Evaluation of foundry project for Ministry of Planning Amman - Jordan*

Prepared for the Government of Jordan
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Daniel Mellor
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United Nations Industrial Development Organization
Vienna

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* This document has not been edited.

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INTRODUCTION

The Arab Engineering Industries Co. (AEICO) has been, for many years, pursuing a project to establish a foundry in Jordan based principally on the production of Malleable Iron Pipe Fittings. Bids were requested and received but there was some doubt as to the validity of the market estimates, upon which the project was based.

The last bids, received in February 89, were based on an annual product mix of 2654 tonnes of Steel castings and approximately 6,000 tonnes of Malleable Iron Pipe Fittings, of which, not less than 3000 tonnes of fittings were to be exported.

In January 89 the Government of Jordan requested UNIDO to provide a foundry expert to evaluate the project and Mr. Rudolf Paulicek carried out this work in Amman from 7-12th January, for the Ministry of Planning, on behalf of UNIDO, Vienna. His work is covered by a report dated January 10,1989.

Following receipt of this report, The Minister of Planning in Jordan, requested further assistance for a more detailed evaluation of the project which was to comprise three aspects.

a) Re-evaluation of the existing market survey and the compilation of additional data, in order to prepare a rational production schedule.

b) Preparation and analysis of several possible programmes, specification of equipment and technology and preparation of a tender document.

c) Preparation of an approximate financial analysis of the most reasonable alternatives.

The work was scheduled to cover a period of 2 months starting on 12th March 89.

Item a) (Market Survey) was completed by 8th April 89 and is the subject of a separate report under the same project No DP/JOR/87/009.

Item b) is the subject of this report.

Item c) (Financial analysis) has been deferred, with the agreement of the Ministry of Planning, until the revised offers are received from bidders. It is anticipated that this will be in Mid-June 89. At that time the author of this report (D. Mellor), together with a UNIDO Financial Analyst, will be responsible for the appraisal of the new bids and will prepare a financial evaluation of the project.

I - METHOD OF APPROACH

A - Data Collection / Analysis

Existing Specifications

Technical specifications written by the original project consultants, Messrs Foundry Management and Design Co., were received and reviewed.

Previous Bids

Previous bids covering several different production programmes were made available by Arab Engineering Industries Co and reviewed for content and compliance with specifications.

Production Programmes

New production programmes were developed from the data collected in the Market Survey.

B - Specify Equipment and Technology

Technology, processes and equipment

These were determined from the requirements of the new production programmes with a view to:-

- reducing investment costs
- minimizing operating costs
- increasing use of local process materials where practical
- replacing expensive, sophisticated equipment, with simpler forms (wherever possible) and providing greater flexibility in the plant operation.

C - Study Team

Most of the work was carried out at the premises of AEICO and was done with the close co-operation of the General Manager Eng. Ali Obeidat, the Chief Engineer Dr. A Abu Safiah and members of AEICO staff.

II - SUMMARY

a) Production programmes have been prepared for:-

(1)	Malleable Iron Pipe Fittings	2165 tonnes
	Engineering Castings	1724 tonnes
	Steel Castings	2654 tonnes
	Annual Total	6543 tonnes

Alternatively:

(2)	Malleable Iron Pipe Fittings	4828 tonnes
	Steel Castings	2654 tonnes
	Annual Total	7482 tonnes

b) Technology and Equipment have been reviewed and proposals made to reduce investment costs and improve the viability of the project.

c) New tender documents have been prepared and are available for forwarding to bidders.

d) In order to further reduce investment costs, the aim during final negotiations, should be to eliminate from the Turn-Key contract any equipment or services for which bidders will take a "mark-up" without adding any significant benefit to the purchase-price of that equipment or service.

e) This report expresses no views on the viability of the project as this will only be assessed after receipt of the new bids and the subsequent financial analysis.

At that time the relative technical merits of the bids and bidders will also be considered

III - FINDINGS

A - New Production Programme

Malleable Pipe Fittings

It was necessary to determine the correct unit weights to be used for these fittings. As far back as the 1984 Foundry Management and Design Co study, there had been confusion between the weights of fittings, before machining and after machining, and there is a difference of 15% to 20% between these two states. All new malleable pipe fittings programmes will based on the DIN 2950 schedule of finished (machined) weights.

Based on the Market Survey there will be an annual, local, sales potential of 2000 tonnes of fittings by the time the foundry is in full production. Using the revised unit weights this represents 15% - 20% more units than previously calculated and hence a similar increase in Sales value.

To this 2000 tonnes will be added 165 tonnes of pipe couplings required by The Jordan Pipe Co., making a total of 2165 tonnes.

Original pipe fitting schedules used by bidders, were based on 112 different items. These were reviewed and reduced to 74 types, covering all those ordered in large quantities by Jordanian importers and permitting other types to be achieved by the combination of two fittings. This will result in a substantial reduction in the cost of pattern equipment and allow longer, more economical, production runs. It will be possible to widen the fittings range at some future date if required.

The new Malleable Fittings programme is detailed in Appendix 1. This is based on local Malleable Fittings requirements only and takes no account of export sales.

Engineering Castings for the Automatic (DISA) Moulding Line

A detailed examination was made of the castings in this group which were identified in the Market Survey. This revealed that there were errors in some earlier schedules which had been prepared by bidders and certain castings were too large for the DISA moulding machine. This necessitated the deletion of these items, although they can be made on the other moulding line (Steel casting line) if it is considered economical to include them. These deletions, together with the transfer of the Pipe Couplings to the Fitting's programme, reduced the annual tonnage of Engineering Castings for the DISA line to 1724 tonnes. Within this tonnage, layouts (numbers of castings per mould) had to be revised in some cases. The resulting programme is detailed in Appendix 2.

DISA Production Programme

The overall production programme for the DISA line benefits from a broader base with the inclusion of Engineering Castings and is not so dependant on orders for Malleable Pipe Fittings.

However, although it is made up mainly of types of castings which are frequently made on DISA lines, it is not a balanced programme. There is a wide range of piece weights with, in consequence, widely differing metal supply demands. Three types of metals are required (Malleable, Ductile and Grey Irons) and this will increase the task of the Management in respect of Production Control and Quality Control.

It is therefore proposed that an alternative DISA programme be evaluated with the line dedicated entirely to Malleable Fittings. For this purpose a separate fittings programme has been developed and is shown in Appendix 4. This totals 4828 tonnes per year of which 2165 tonnes represents local demand and 2663 tonnes for which export orders will have to be obtained.

Steel Castings for the Pattern - Flow Moulding Line

The Market Survey confirmed the previous annual sales programme totalling 2654 tonnes. The existing programme has been retained and is shown in Appendix 3.

There is however, a demand within Jordan, for other castings which could be made on this line and AEICO should therefore be able to select those which give the most advantageous results.

Overall Programme Summary

Programme 1

DISA LINE	Malleable Pipe Fittings	2165 Tonnes
	Engineering Castings	1724 Tonnes
PATTERN-FLOW LINE	Steel Castings etc	2654 Tonnes
	Total	6543 Tonnes

Programme 2

DISA LINE	Malleable Pipe Fittings	4828 Tonnes
PATTERN-FLOW LINE	Engineering Castings	2654 Tonnes
	Total	7482 Tonnes

These two programmes form the basis of the revised request for bids. Programme 1 does not fully load the DISA line and plant design and layout will be so arranged to permit the full production potential to be achieved when required. Where possible this will be achieved by 3 shift working.

Programme 2 will utilise 3 shift working, wherever possible, from the outset.

Other Products

As noted in the Market Survey there are other products which could provide additional loading for the foundry. These include:-

Pipe Wrenches
Engineer's Vices
Bearing Blocks
Boilers
Turnbuckles . etc

They all require finishing operations outside the present scope of the foundry's equipment. e.g. machining, assembly with steel forgings etc.

It is not proposed that any such items should be taken into account when the financial analysis is carried out but they could provide not only additional casting orders, but could form the basis of new engineering businesses for Jordan.

B - Equipment and Technology

Review of Existing Specifications and Bids

The original specifications and equipment lists are comprehensive and still relevant in most respects. However, the changes to the production programme and the need to reduce investment and operating costs necessitated a number of alterations.

Previous specifications had been issued in 11 separate Packages as listed below.

Package 1	Stockyard and Melting
Package 2	New Sand Preparation Plant
Package 3	Malleable Iron Fittings Manufacture
Package 4	Pattern-Flow Moulding Line (Steel)
Package 5	Core Making
Package 6	Finishing and Fettling
Package 7	Cranes
Package 8	Dust and Fume Extraction
Package 9	(Deleted)
Package 10	Buildings and Services
Package 11	Supplementary Plant

Initially it had been intended to issue separate contracts for each package but at some stage, during the long history of the project, this had been changed to a Turn-Key contract under which the successful bidder would take full responsibility.

It was decided that the best way of advising the bidders of the changes now being proposed to Equipment and Technology, would be by reference to these packages and this is done in the following sections of this report.

C - Changes to Technology and Equipment

Working Time

For Programme 1, all operations will continue to be based on 2 x 8 hour shifts per day, for 284 days per year with the exception of the Heat Treatment and Annealing sections which will work 24 hours x 7 days per week. The Maintenance section will also have to work 7 days per week.

For Programme 2, (with the DISA dedicated entirely to Pipe-Fittings) the Galvanising, Machining and subsequent operations will be

based on 3 shifts.

Package 1 Stockyard and Melting

There was no need for any radical changes to the existing specifications. Even when the DISA line is not fully loaded for 16 hours per day, it is necessary to provide sufficient metal to allow the line to operate at it maximum rate during the hours it does work. The 2 x 3.2 tonne capacity - 1750 kw, coreless induction furnaces previously specified are suitable for this requirement.

Assurances are to be sought from bidders that it will be possible to re-line one of these furnaces during the one-day weekend at AEICO.

Since Ductile Iron has now been reintroduced to production programme No 1, equipment for de-sulphurising has to be supplied.

Package 2 New Sand Preparation Plant

There was no need to change the existing specifications but, since steel castings were not included in the original programme when these specifications were written, bidders are to be asked for proposals for supply of special facing sands for steel. e.g. chromite and olevine.

Package 3 Malleable Iron Fittings Manufacture

This line now has to cater for the production of engineering castings in Ductile, Malleable and Gray Iron in addition to the Pipe Fittings.

a) - Moulding Line

The revised production programme No 1 requires approximately 930,000 moulds per year based on a 600 mm x 480 mm mould size. Most bidders previously included the DISAMATIC 2013 MK4/PLC machine and the new programme will still require this or an alternative with similar capacity. The associated sand plant must have sufficient output to cater for 100% moulding rate. Programme No 2 absorbs the full capacity of this size of DISA, based on 75% utilisation of available time.

It would be possible to replace the DISA with a conventional, horizontally parted, boxed, moulding line but there is no moulding unit better suited to the production of Malleable Fittings than a boxless machine of the DISA type. The alternatives would offer little by way of reduction in capital cost; would require much more manpower and would introduce additional quality control problems by way of maintenance of moulding box tolerances. These, and other factors, militate against the

proposal of an alternative moulding method.

b) - Rotary Shake-out

It is necessary to retain a rotary drum type of shake-out as small pipe fittings would be lost through the bars of a conventional horizontal type unit. However, the shake-out previously specified is a costly version which provides for the cooling of both sand and castings in addition to separating sand from the castings.

Bidders have been asked to consider a simpler rotary drum unit which does not cater for cooling. Sand would then be cooled in the return sand system and castings cooled by other means.

c) - Shotblast

The specifications called for a continuous, through type, machine "in-line" with the moulding machine and the rotary drum shake-out, and this is again an expensive solution. In addition the placing of these three units "in-line" increases the chance of lost time since a breakdown to any one will stop the line.

Some bidders had proposed a cheaper alternative of 2 batch barrel type shotblast machines with automatic loading and discharge. This alternative has been stated to be acceptable in the revised specifications.

d) - Pouring

The re-introduction of Ductile Iron complicates the pouring requirements. The previously specified auto-pouring unit could be replaced with a channel type holder with pouring from ladles suspended from a monorail. However, this would have three serious deficiencies:-

- Speed of mould output would be governed by the efficiency of the operators doing the manual pouring.
- Pouring rate, and hence the quality of the product, would again be dependant on the skill of the operators.
- Metal spillage on the moulds would probably be greater.

For these reasons it is proposed to retain the auto-pouring unit and bidders are asked to provide additional means of inoculating (magnesium treatment) and pouring Ductile Iron for Programme 1.

e) - Annealing

Previous specifications were based on a continuous - pusher type-annealing furnace. The use of batch type furnaces will offer a considerable reduction in investment and, in addition, will provide greater flexibility to heat treat both Malleable and Ductile irons. Capital expenditure might also be phased with additional units being added as output increases.

f) - Fettling (Barrelling,Grinding,Broaching,Sizing)

No change is proposed to specifications other than making the equipment cater for the requirements of the new production programmes.

The number of grinding machines covered by the original specifications was based on the premise that only 10% of the Malleable Pipe Fittings would require grinding. The author questions this premise and the matter should be fully discussed, and guaranteed, by bidders during future negotiations.

g) - Galvanizing

Existing specifications were found to be satisfactory but the capacity must be matched to the requirements of the new product mix.

h) - Machining

The new product mix has less types of fittings and a smaller annual tonnage than in earlier programmes. It should therefore be possible to reduce the number of screwing and tapping machines and so lower the investment cost. For any subsequent increase in Pipe fitting orders; 3 shift working should be adopted.

The previous bids do not appear to give any details of set-up time required when changing from one type of fitting to another. It is felt that this might be a significant factor and bidders will have to provide details for each machine.

i) - Pressure Test, Degrease, Varnish, Weigh, Pack etc

It was not considered necessary to change these specifications.

j) - Pattern Equipment

Since the range of pipe fittings has been reduced from 112 items to

74 there should be a corresponding reduction in costs.

It is recommended that all patterns and core boxes for Malleable Pipe Fittings should be purchased as part of the Turn-Key supply. All other pattern equipment for Engineering and Steel Castings should be made by AEICO within their own pattern shop. It would be impractical and too costly to include these in the bidder's supply.

There is a further possibility of reducing the cost of pattern equipment. In Package 5 (Coremaking) it is proposed to allow the bidders to substitute the Cold Box process for the previously specified Shell process, provided it can be shown to offer an overall advantage. If adopted, some of the metal pattern equipment could be replaced with less costly resin tooling.

Package 4 Steel Casting Moulding

No change is proposed to the specifications which were used when AEICO called for bids in July 1988.

Package 5 Coremaking

The size and quantity of equipment must match the requirements of the new production programme.

All previcus specifications have been based on the Shell (Croning) Process. An alternative is the Cold Box Process which offers the following advantages.

- less energy required (no heating of core boxes)
- production rate can be twice as fast
- cheaper core boxes can be used.
- greater dimensional stability of cores.

However, there are disadvantages:

- process needs closer control
- shelf life of materials more critical
- greater control required to prevent environmental and health hazards.
- higher capital cost of individual machines (but fewer machines)

Bidders are therefore told they may offer the Cold Box Process but must fully justify its inclusion.

Package 6 Steel Finishing Facility

It was not considered necessary to issue new specifications.

Package 7 Cranes

Other than the addition of any cranes required for batch type annealing furnaces, no changes were proposed.

Package 8 Dust and Fume Extraction

No change other than matching the plant to meet the needs of any changes to equipment.

Package 10 Building and Services

Bidders are requested to re-examine the size of buildings in relation to the new production programme.

A much more important consideration is whether this package should be included in the Turn-Key project. A Jordanian contractor will be used and with the exception of certain steel work and electrical equipment from overseas, Package 10 will not be covered by the favourable financing terms. However, as long as it remains part of the Turn Key project the bidders will apply their mark-up to the price.

It is recommended that consideration be given to removing the Package 10 from the Turn Key supply during final negotiations.

Package 11 Supplementary Plant

This package covers three main areas

- Pattern Shop
- Maintenance Shop
- Laboratory

a) Pattern Shop

No changes to specifications but bidders must include all necessary equipment to permit AEICO to make, repair, and maintain the designated range of pattern equipment.

b) Maintenance Shop and Laboratory

No changes to specifications.

All of the equipment in Package 11, virtually forms a shopping list with little or no design work or engineering required from the bidders. Yet, discussions with AEICO personnel suggest that the purchase prices of much of this equipment has been marked up by 20% - 30%.

It could be purchased direct by AEICO thus avoiding this mark-up but it would then probably fall outside the scope of the financing packages.

It is not proposed to raise this matter with bidders until final negotiations take place as this will prevent them moving the mark-up to other equipment.

D - Turn - Key Installation

Requirements relating to the scope of the turn-key contract have not been changed. There is however no doubt that the earlier change from the concept of 11 separate packages to the turn-key contract has added greatly to the overall investment cost. It is recognised that it has also provided benefits by way of better financing terms than could have been obtained for the packages.

However, during the final contract negotiations with bidders, there should be the possibility of modifying the scope of supply to reduce costs. For example; the successful bidder will be responsible for hiring and paying all of the local labour required for the erection of the plant. If his supply was limited to providing the overseas specialists required for the supervision of the erection and commissioning, there should be a cost saving. There could also be an element of risk by way of split responsibilities but such risks must be weighed against the benifits.

In the revised invitations to bidders there have been few changes but emphasis has been placed on the Training needs and in particular for Pattern Making and Foundry Methods expertise for the start-up and initial operating period. (Included in Appendix 5).

The attention of bidders has been drawn to the need to consider all means of reducing the investment and operating costs in order to improve the feasibility and viability of the project.

The bidders have been asked to submit two separate proposals. One based on Production Programme No 1 and the other on No. 2.

IV - Financial Analysis

This should be carried out as soon as the new bids are received. At the time of writing this report, it is intended that this shall be in Mid June 1989.

It is planned that a 3 week visit to Amman will then be made by a UNIDO foundry expert together with a Financial Analyst. They will be responsible for the appraisal of all the bids and the preparation of a comprehensive report on the financial and economic (social cost-benefit) evaluation of the project.

The financial analyses will examine both offers (i.e. on Programme 1 and 2) and sensitivity analyses will be carried out assuming higher and lower values of variables.

Appendix 1 — MALLEABLE IRON CASTINGS — AEICO

Sheet 1 of 6 — (MOULDING LINE 2) — April 1989

1	2	3	4	5	6	7	8	9
Item No.	Description	Pieces Per Year Net	Unit Weight Kg	Annual Weight Net t	Pieces Per Year Gross	Annual Weight Gross t	No. Per Plate	Moulds Per Year
	Malleable cast iron pipe fittings according to ISO R 49 and DIN 2950							
1	Elbow A1 - 90 - 1/2"	2000000.000	0.091	182.000	2198000.000	234.780	40.000	54950.000
2	dito 3/4"	600000.000	0.137	82.200	659400.000	106.038	32.000	20606.250
3	dito 1"	250000.000	0.209	52.250	274750.000	67.403	18.000	15263.889
4	dito 1 1/4"	100000.000	0.332	33.200	109900.000	42.828	16.000	6868.750
5	dito 1 1/2"	50000.000	0.427	21.350	54950.000	27.542	12.000	4579.167
6	dito 2"	100000.000	0.652	65.200	109900.000	84.108	8.000	13737.500
7	Elbow A4 - 92 - 1/2"	200000.000	0.094	18.800	219800.000	24.252	40.000	5495.000
8	dito 3/4"	100000.000	0.145	14.500	109900.000	18.705	32.000	3434.375
9	dito 1"	100000.000	0.228	22.800	109900.000	29.412	18.000	6105.556
10	Tee B1 - 130 - 1/2"	700000.000	0.130	91.000	769300.000	117.390	40.000	19232.500
11	dito 3/4"	200000.000	0.187	37.400	219800.000	48.246	32.000	6868.750
12	dito 1"	80000.000	0.282	22.560	87920.000	29.102	18.000	4884.444
	Sub-total	4480000.000		643.260	4923520.000	829.805		162026.181

N.B. All unit weights are finished fittings,
i.e after machining

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1	2	3	4	5	6	7	8	9
Item No.	Description	Pieces PER Year Net	Unit Weight Kg	Annual Weight Net t	Pieces Per Year Gross	Annual Weight Gross t	No. Per Plate	Moulds Per Year
13	Tee B1 - 130 - 1 1/4"	80000.000	0.435	34.800	87920.000	44.892	12.000	7326.667
14	dito 1 1/2"	70000.000	0.570	39.900	76930.000	51.471	8.000	9616.250
15	dito 2"	70000.000	0.880	61.600	76930.000	79.464	6.000	12821.667
16	Long sweep bend G1-2 1/2"	150000.000	0.000	0.000	164850.000	0.000	24.000	6868.750
17	dito 3/4"	200000.000	0.246	49.200	219800.000	63.468	24.000	9158.333
18	dito 1"	150000.000	0.399	59.850	164850.000	77.207	15.000	10990.000
19	dito 1 1/4"	100000.000	0.642	64.200	109900.000	82.818	6.000	18316.667
20	dito 1 1/2"	60000.000	0.881	52.860	65940.000	68.189	4.000	16485.000
21	dito 2"	40000.000	1.480	59.200	43960.000	76.368	4.000	10990.000
22	Union taper seat U11 - 340 - 1/2"			0.000	0.000	0.000		
	380	200000.000	0.210	42.000	219800.000	54.180	30.000	7326.667
	(3 Parts) 381	200000.000	0.000	0.000	219800.000	0.000	50.000	4396.000
	374	200000.000	0.000	0.000	219800.000	0.000	48.000	4579.167
	Sub-total	1520000.000		463.610	1670480.000	598.057		118875.167

MALLEABLE IRON CASTINGS

(MOULDING LINE 2)

AEICO

April 1989

1	2		3	4	5	6	7	8	9
Item No.	Description		Pieces Per Year Net	Unit Weight Kg	Annual Weight Net t	Pieces Per Year Gross	Annual Weight Gross t	No. Per Plate	Moulds Per Year
23	Union taper seat U11 - 340 - 3/4"								
		380	70000.000	0.271	18.970	76930.000	24.471	30.000	2564.333
	(3 parts)	381	70000.000	0.000	0.000	76930.000	0.000	56.000	1373.750
		374	70000.000	0.000	0.000	76930.000	0.000	48.000	1602.708
24	dito	1"							
		380	100000.000	0.351	35.100	109900.000	45.279	30.000	3663.333
	(3 Parts)	381	100000.000	0.000	0.000	109900.000	0.000	56.000	1962.500
		374	100000.000	0.000	0.000	109900.000	0.000	48.000	2289.583
25	dito	1 1/4"							
		380	50000.000	0.601	30.050	54950.000	38.765	30.000	1831.667
	(3 parts)	381	50000.000	0.000	0.000	54950.000	0.000	42.000	1308.333
		374	50000.000	0.000	0.000	54950.000	0.000	30.000	1831.667
26	dito	1 1/2"							
		380	40000.000	0.735	29.400	43960.000	37.926	24.000	1831.667
	(3 parts)	381	40000.000	0.000	0.000	43960.000	0.000	24.000	1831.667
		374	40000.000	0.000	0.000	43960.000	0.000	24.000	1831.667
27	dito	2"							
		380	40000.000	1.150	46.000	43960.000	59.340	20.000	2198.000
	(3 parts)	381	40000.000	0.000	0.000	43960.000	0.000	20.000	2198.000
		374	40000.000	0.000	0.000	43960.000	0.000	20.000	2198.000
		Sub-total	900000.000		159.520	989100.000	205.781		30516.875

Sheet 4 of 6

MALLEABLE IRON CASTINGS

(MOULDING LINE 2)

AEICO

April 1989

Item No.	Description	Pieces Per Year Net	Unit Weight Kg	Annual Weight Net t	Pieces Per Year Gross	Annual Weight Gross t	No. Per Plate	Moulds Per Year
28	Socket M2 - 270 - 1/2"	723000.000	0.061	44.103	794577.000	56.893	42.000	18918.500
29	dito 3/4"	358000.000	0.093	33.294	393442.000	42.949	42.000	9367.667
30	dito 1"	232000.000	0.133	30.856	254968.000	39.804	35.000	7284.800
31	dito 1 1/4"	88000.000	0.208	18.304	96712.000	23.612	35.000	2763.200
32	dito 1 1/2"	53000.000	0.268	14.204	58247.000	18.323	24.000	2426.958
33	dito 2"	130000.000	0.441	57.330	142870.000	73.956	16.000	8929.375
34	dito 2 1/2"	9000.000	0.735	6.615	9891.000	8.533	12.000	824.250
35	dito 3"	5500.000	1.030	5.665	6044.500	7.308	8.000	755.563
36	Hexagon nipple N8 - 280 - 1/2"	600000.000	0.060	36.000	659400.000	46.440	54.000	12211.111
37	dito 3/4"	300000.000	0.087	26.100	329700.000	33.669	54.000	6105.556
38	dito 1"	200000.000	0.140	28.000	219800.000	36.120	40.000	5495.000
39	dito 1 1/4"	150000.000	0.223	33.450	164850.000	43.151	30.000	5495.000
40	dito 1 1/2"	100000.000	0.264	26.400	109900.000	34.056	24.000	4579.167
41	dito 2"	90000.000	0.403	36.270	98910.000	46.788	16.000	6181.875
	Sub-total	3038500.000		396.591	3339311.500	511.602		91338.021

Sheet 5 of 6

MALLEABLE IRON CASTINGS

(MOULDING LINE 2)

AEICO

April 1989

1	2	3	4	5	6	7	8	9
Item No.	Description	Pieces Per Year Net	Unit Weight Kg	Annual Weight Net t	Pieces Per Year Gross	Annual Weight Gross t	No. Per Plate	Moulds Per Year
42	Plug T9 - 290 - 1/2"	660000.000	0.038	25.080	725340.000	32.353	90.000	8059.333
43	dito - 1"	140000.000	0.106	14.840	153860.000	19.144	70.000	2198.000
44	Reducing elbow A1 - 90 - 3/4" x 1/2"	100000.000	0.119	11.900	109900.000	15.351	32.000	3434.375
45	Reducing tee B1 - 130 - 3/4" x 1/2"	220000.000	0.162	35.640	241780.000	45.976	32.000	7555.625
46	dito - 1" x 3/4"	140000.000	0.242	33.880	153860.000	43.705	18.000	8547.778
47	dito - 1" x 1/2"	96000.000	0.226	21.696	105504.000	27.988	18.000	5861.333
48	dito - 1 1/4" x 1"	56000.000	0.368	20.608	61544.000	26.584	12.000	5128.667
49	dito - 1 1/4" x 3/4"	20000.000	0.323	6.460	21980.000	8.333	12.000	1831.667
50	dito - 1 1/4" x 1/2"	54000.000	0.310	16.740	59346.000	21.595	12.000	4945.500
51	dito - 1 1/2" x 1 1/4"	71000.000	0.495	35.145	78029.000	45.337	8.000	9753.625
52	dito - 3/4" x 1/2" x 1/2"	100000.000	0.149	14.900	109900.000	19.221	32.000	3434.375
53	dito - 1" x 3/4" x 3/4"	50000.000	0.223	11.150	54950.000	14.384	18.000	3052.778
54	dito - 1" x 1/2" x 3/4"	50000.000	0.204	10.200	54950.000	13.158	18.000	3052.778
55	dito - 1 1/4" x 3/4" x 1"	120000.000	0.290	34.800	131880.000	44.892	12.000	10990.000
	Sub-total	1877000.000		293.039	2062823.000	378.020		77845.833

N.B. Method of specifying sequence of outlets on tees is ISO49 "a"

MALLEABLE IRON CASTINGS

(MOULDING LINE 2)

April 1989

1	2	3	4	5	6	7	8	9
Item No.	Description	Pieces Per Year Net	Unit Weight Kg	Annual Weight Net t	Pieces Per Year Gross	Annual Weight Gross t	No.Per Plate	Moulds Per Year
56	Elbow A4-45 - 121 - 1/2"	200000.000	0.078	15.600	219800.000	20.124	42.000	5233.333
57	dito - 3/4"	250000.000	0.122	30.500	274750.000	39.345	32.000	8585.938
58	dito - 1"	200000.000	0.180	36.000	219800.000	46.440	18.000	12211.111
59	dito - 1 1/4"	70000.000	0.290	20.300	76930.000	26.187	12.000	6410.833
60	Bushing N4 - 241 - 3/4" x 1/2"	70000.000	0.047	3.290	76930.000	4.244	54.000	1424.630
61	dito - 1" x 1/2"	100000.000	0.094	9.400	109900.000	12.126	40.000	2747.500
62	dito - 1" x 3/4"	150000.000	0.075	11.250	164850.000	14.513	40.000	4121.250
63	dito - 1 1/4" x 1/2"	30000.000	0.178	5.340	32970.000	6.889	32.000	1030.313
64	dito - 1 1/4" x 3/4"	50000.000	0.160	8.000	54950.000	10.320	32.000	1717.188
65	dito - 1 1/4" x 1"	70000.000	0.120	8.400	76930.000	10.836	24.000	3205.417
66	dito - 1 1/2" x 1/2"	25000.000	0.246	6.150	27475.000	7.934	24.000	1144.792
67	dito - 1 1/2" x 3/4"	25000.000	0.220	5.500	27475.000	7.095	24.000	1144.792
68	dito - 1 1/2" x 1"	70000.000	0.187	13.090	76930.000	16.886	24.000	3205.417
69	dito - 1 1/2" x 1 1/4"	50000.000	0.105	5.250	54950.000	6.773	24.000	2289.583
70	dito - 2" x 1/2"	10000.000	0.348	3.480	10990.000	4.489	16.000	686.875
71	dito - 2" x 3/4"	10000.000	0.368	3.680	10990.000	4.747	16.000	686.875
72	dito - 2" x 1"	15000.000	0.400	6.000	16485.000	7.740	16.000	1030.313
73	dito - 2" x 1 1/4"	20000.000	0.346	6.920	21980.000	8.927	16.000	1373.750
74	dito - 2" x 1 1/2"	40000.000	0.273	10.920	43960.000	14.087	16.000	2747.500
	Sub-total	1455000.000		209.070	1599045.000	269.700		60997.407
	GRAND TOTAL	13270500.000		2165.090	14584279.500	2792.966		541599.484

APPENDIX 2 — Engineering Castings For Moulding Line 2 — April 1989

Sheet 1 of 4

ITEM No.	DESCRIPTION	PIECES PER YEAR NET	UNIT WEIGHT Kg	ANNUAL WEIGHT NET t	PIECES PER YEAR GROSS	PATTERN IMPRESSIONS	ANNUAL PATTERN CYCLE
	Ductile Iron Pipe Fittings to ISO 2531						
	Grade of Iron DIN 1693 GGG 40						
1	Double Socket 1/4 Bend DN100	7105.000	11.400	80.997	7640.000	1.000	7640.000
2	Double Socket 1/4 Bend DN150	6824.000	20.500	139.892	7343.000	1.000	7343.000
4	Double Socket 1/8 Bend DN100	7326.000	10.100	73.993	7631.000	1.000	7631.000
5	Double Socket 1/8 Bend DN150	7414.000	17.400	129.004	7723.000	1.000	7723.000
	Ductile Iron Anchor Straps						
	Grade Of Iron DIN 1693 GGG 40						
32	BVS DN100	9598.000	2.900	27.834	10103.000	2.000	5051.500
33	BVS DN150	8272.000	3.700	30.606	8707.000	2.000	4353.500
	Ductile Iron Engineering Castings						
	Grade Of Iron DIN 1693 GGG 50						
41	Pandrol Shoulder	100000.000	1.150	115.000	106283.000	8.000	13285.375
42	Pandrol Insert	100000.000	0.350	35.000	106283.000	16.000	6642.688
	Grey Iron Drainage Fittings to DIN 19						
	500-19 509,19 522 & ISO 6549						
	Grade of Iron DIN 1691 GG 20						
141	GA Bend 87 Deg. DN100	10000.000	4.000	40.000	10417.000	2.000	5208.500
142	SML Bend 88 Deg. DN100	6000.000	2.100	12.600	6250.000	4.000	1562.500
143	GA Bend 87 Deg. DN150	4000.000	8.400	33.600	4167.000	1.000	4167.000
144	SML Bend 88 Deg. DN150	3000.000	4.900	14.700	3125.000	2.000	1562.500
145	GA Double Branches 87 Deg.,DN100/100/100	5000.000	6.500	32.500	5263.000	1.000	5263.000
	Sub-Total	274539.000		765.726			77433.563

APPENDIX 2

Engineering Castings For Moulding Line 2

ITEM NO.	DESCRIPTION	PIECES PER YEAR NET	UNIT WEIGHT Kg	ANNUAL WEIGHT Net t	PIECES PER YEAR GROSS	PATTERN IMPRESSIONS	ANNUAL PATTERN CYCLES
146	SML Double Bran. 88 Deg.,DN1 100,DN2 100	3000.000	3.200	9.600	3158.000	2.000	1579.000
147	GA Double Branches 87 Deg,DN150/150/150	1000.000	14.100	14.100	1053.000	1.000	1053.000
149	GA Double Branches 87 Deg,DN100/100/70	1000.000	5.800	5.800	1053.000	1.000	1053.000
151	GA double Branches 87 Deg,DN1150/150/100	2000.000	13.000	26.000	2105.000	1.000	2105.000
152	SML Double Bran. 88 Deg,DN2 150,DN3 100	1500.000	7.000	10.500	1579.000	1.000	1579.000
	Grey Iron Engineering Castings						
	Grade Of Iron DIN 1691 Special						
171	Railway Brake Block	19000.000	11.000	209.000	19588.000	2.000	9794.000
172	Railway Brake Block	1080.000	11.000	11.880	1114.000	2.000	557.000
	Grade Of Iron GG20						
184	Gas Burner 1	32000.000	0.300	9.600	34783.000	20.000	1739.150
185	Gas Burner 2	32000.000	0.300	9.600	34783.000	16.000	2173.938
186	Gas Burner 3	32000.000	0.400	12.800	34783.000	12.000	2898.583
187	Gas Burner 4	32000.000	0.500	16.000	34783.000	12.000	2898.583
188	Gas Burner 4	32000.000	0.800	25.600	34783.000	6.000	5797.167
189	Burner Support 1 (Grill)	47500.000	1.030	48.925	104396.000	1.000	104396.000
190	Burner Support 2 (Grill)	47500.000	1.160	55.100		1.000	
191	Burner Head	95000.000	0.730	69.350	104396.000	6.000	17399.333
192	Flame Distributor	95000.000	0.180	17.100	102148.000	12.000	
193	Flame Distributor	40000.000	0.180	7.200	43010.000		
194	Burner Support Grill	90000.000	1.100	99.000	97825.000	1.000	97825.000
195	Burner Head	75000.000	0.730	54.750	82417.000	6.000	13736.167
	Sub-Total	678580.000		711.905			266583.921

APPENDIX 2

Engineering Castings For Moulding Line 2

Sheet 3 of 4

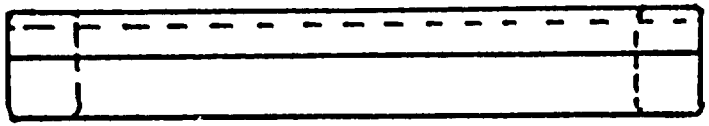
ITEM No.	DESCRIPTION	PIECES PER YEAR NET	UNIT WEIGHT Kg	ANNUAL WEIGHT NET t	PIECES PER YEAR GROSS	PATTERN IMPRESSIONS	ANNUAL PATTERN CYCLES
	Grey Iron Floor and Roof Drains						
	Grade of Iron DIN 1691 GG20						
201	Floor Drain 3 DIN 19586 100x100	3000.000	6.100	18.300	3158.000	2.000	1579.000
202	Grate DIN 19586 89x 89	3000.000	0.600	1.800	3158.000	2.000	1579.000
203	Floor Drain 3 DIN 19587 150x150	1500.000	6.700	10.050	1579.000	1.000	1579.000
204	Grate DIN 19587 137x137	1500.000	1.000	1.500	1579.000	1.000	1579.000
207	Roof Drain 60 11 00 DN 70, 270	1650.000	5.500	9.075	1737.000	2.000	868.500
208	Grate 60 11 03 250	1650.000	5.000	8.250	1737.000	2.000	868.500
209	Roof Drain 60 11 01 DN100, 270	3850.000	6.000	23.100	4053.000	2.000	2026.500
210	Grate 60 11 02 250	3850.000	5.000	19.250	4053.000	2.000	2026.500
	Scaffold Fittings (Malleable Iron)						
467	Part a)	80000.000	0.390	31.200	86020.000	8.000	10752.500
468	Part b)	20000.000	0.550	11.000	21505.000	12.000	1792.083
469	Part c)	20000.000	0.170	3.400	21505.000	14.000	1536.071
	ELECTRICAL LINE HARDWARE						
	(Galvanized Malleable Iron)						
500	Strain Clamps	7000.000	1.600	11.200	7692.000	2.000	3846.000
501	Connectors	7000.000	0.600	4.200	7692.000		
	Telecommunications						
502	Wire Clamps	6000.000	0.660	3.960	12903.000	16.000	806.438
	Bulldog Grips(Galvanized Malleable Iron)						
503	8 Sizes	500000.000	0.050	25.000	555555.000	Mounted As "Fill - Ups"	
	Sub-Total	660000.000		181.285			30839.092

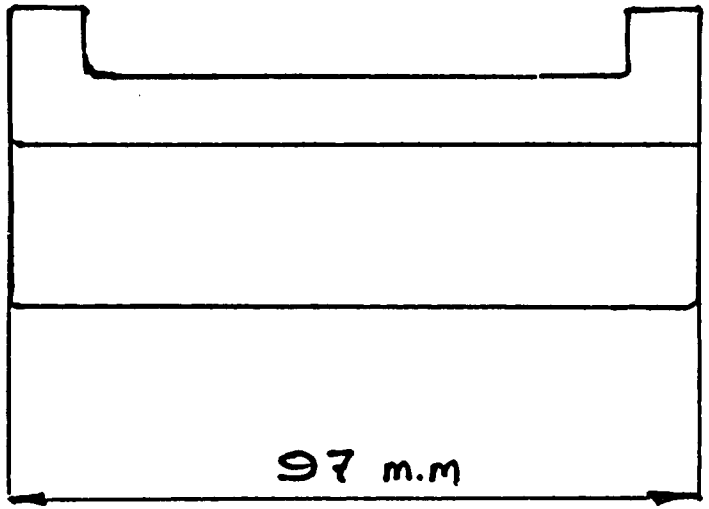
APPENDIX 2 — Engineering Castings For Moulding Line 2

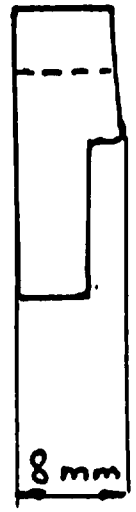
Sheet 4 of 4

ITEM No.	D E S C R I P T I O N	PIECES PER YEAR NET	UNIT WEIGHT Kg	ANNUAL WEIGHT Net t	PIECES PER YEAR GROSS	PATTERN IMPRESSIONS	ANNUAL PATTERN CYCLES
	GALVANISED MALLEABLE IRON HOSE COUPLINGS						
504	Nut 1 1/4"	20000.000	0.110	2.200	22000.000		
505	Body 1 1/4"	20000.000	0.260	5.200	22000.000		
506	Body 1 1/4"	20000.000	0.190	3.800	22000.000		
507	Nut 1 1/2	20000.000	0.120	2.400	22000.000		
508	Body 1 1/2"	20000.000	0.420	8.400	22000.000		
509	Body 1 1/2"	20000.000	0.300	6.000	22000.000		
510	Nut 2"	10000.000	0.220	2.200	11000.000		
511	Body 2"	10000.000	0.600	6.000	11000.000		
512	Body 2"	10000.000	0.370	3.700	11000.000		
513	Nut 2 1/2"	5000.000	0.480	2.400	5500.000		
514	Body 2 1/2"	5000.000	1.080	5.400	5500.000		
515	Body 2 1/2"	5000.000	0.540	2.700	5500.000		
516	Nut 3"	5000.000	0.660	3.300	5500.000		
517	Body 3"	5000.000	1.440	7.200	5500.000		
518	Body 3"	5000.000	0.780	3.900	5500.000		
	Sub-Total	180000.000		64.800			12000.000
	Grand Totals	1793119.000		1723.716			386856.576

PANDROL INSERT ITEM 42



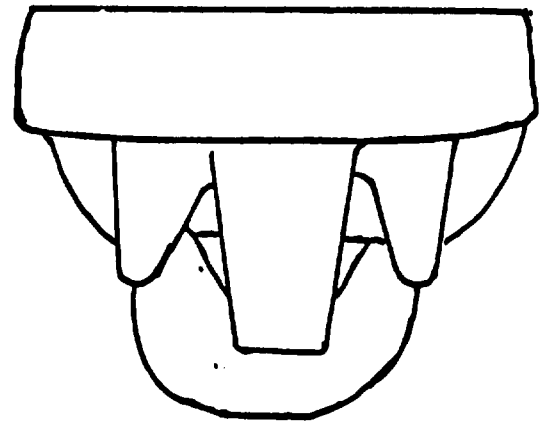




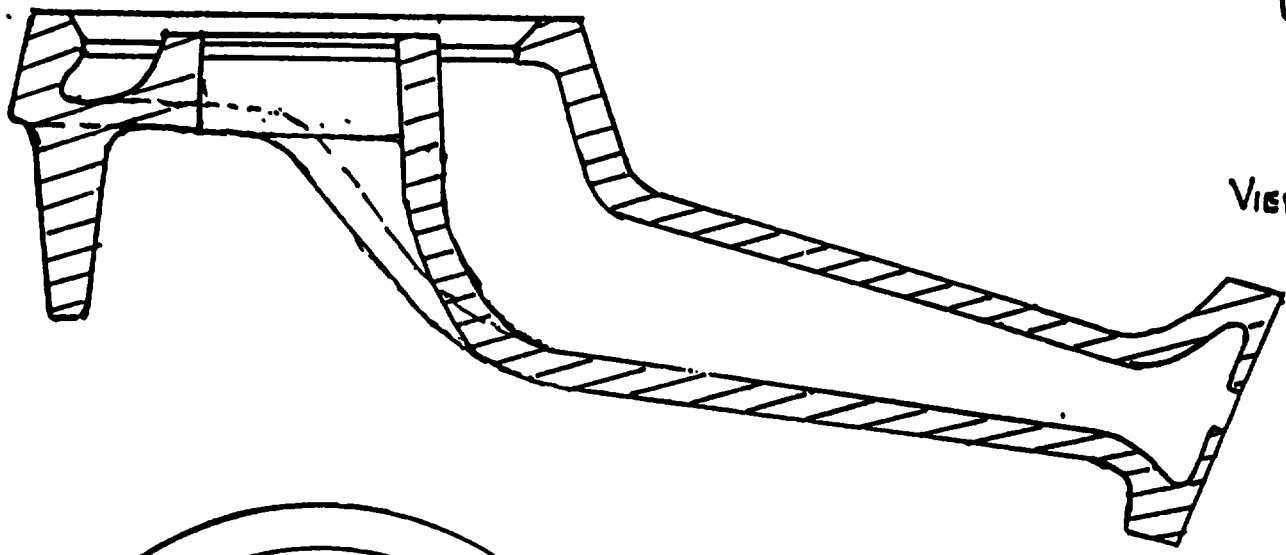
NEW ITEM

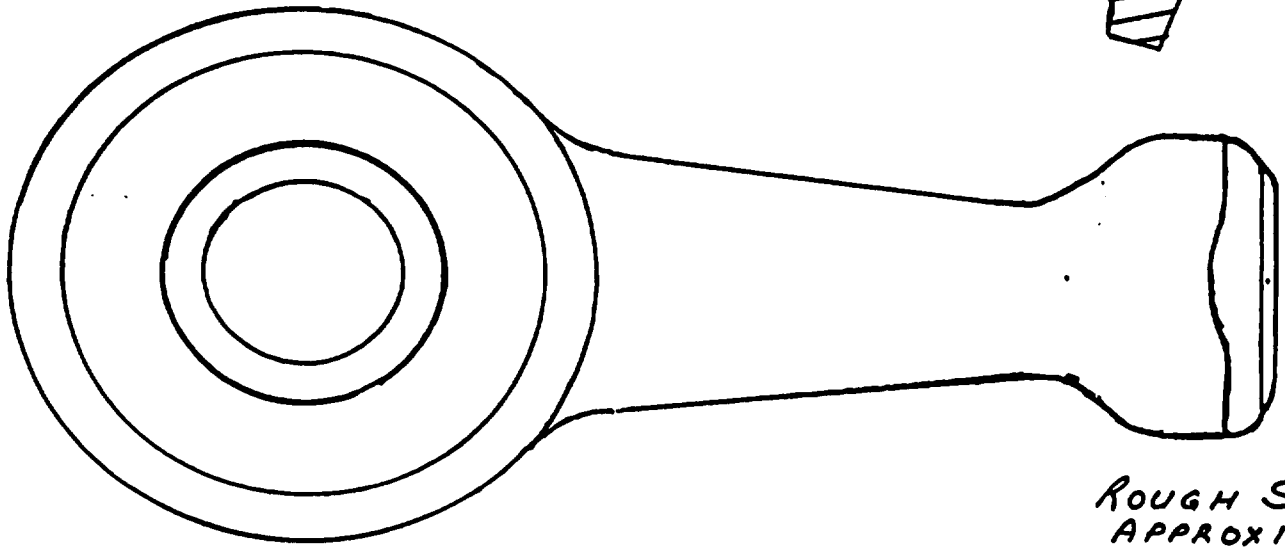
22.4.89

BURNER HEAD
ITEMS N° 191 & 195



VIEW ON A

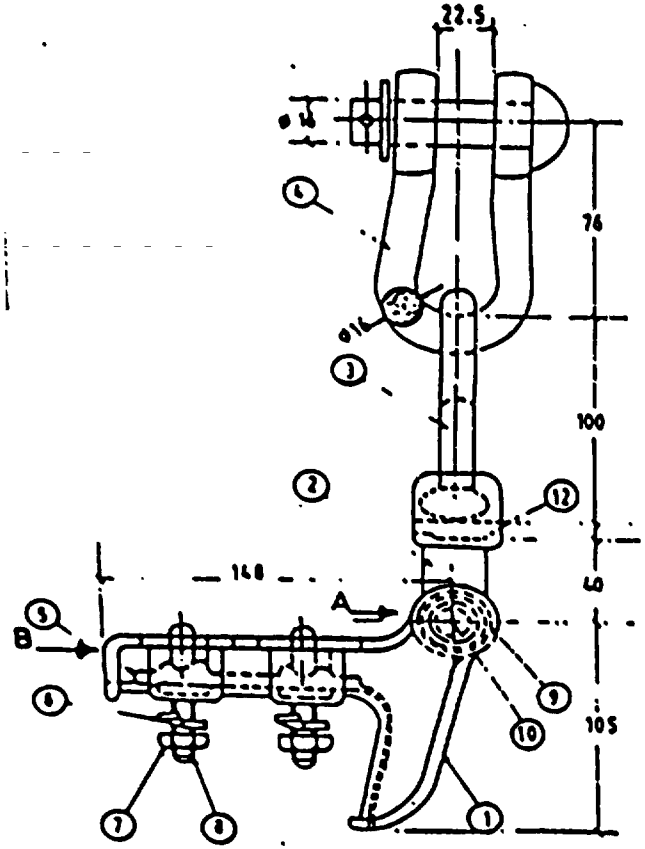


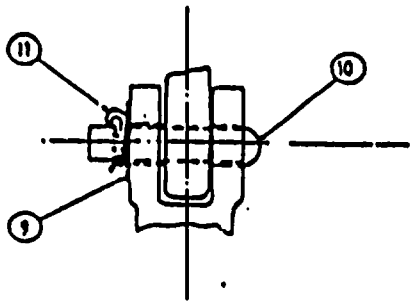


A

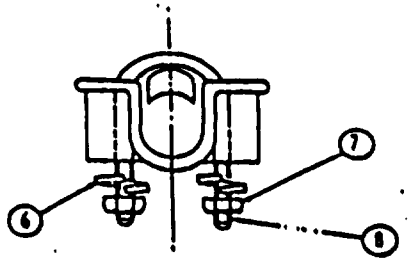
NEW ITEM

ROUGH SKETCH ONLY
APPROXIMATELY FULL SIZE





VIEW FROM 'A'



VIEW FROM 'B'

ITEM No 500 501

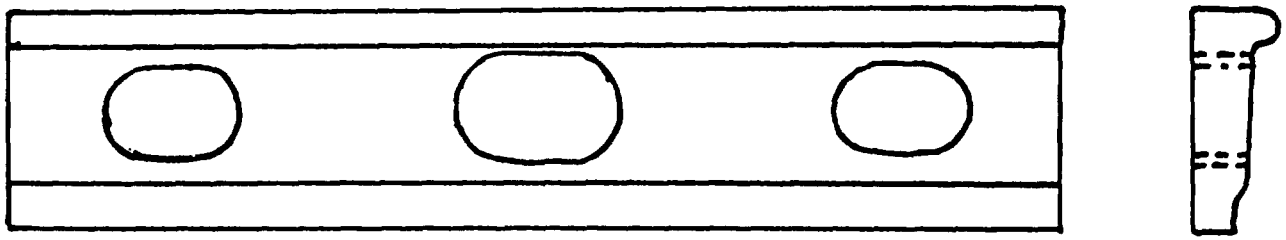
ITEM No.	DESCRIPTION	MATERIAL	QTY. No
1	STRAIN CLAMP WITH ALUMINIUM & STEEL CONDUCTOR	M.C.I. GALVANIZED	1
2	SOCKET EYE	M.C.I. HOT DIP GALVANIZED	1
3	BALL ENDED EYE LINK	FORGED STEEL GALVANIZED	1
4	ANCHOR SHACKLE	FORGED STEEL HOT DIP GALVANIZED	1
5	KEEPER	M.S. HOT DIP GALVANIZED	1
6	SPRING WASHER	SPRING STEEL GALVANIZED	4
7	M.10 NUT	FORGED STEEL GALVANIZED	6
8	M.10 "U" BOLT	FORGED STEEL GALVANIZED	2
9	18MM THICK PLAIN WASHER	M.S. GALVANIZED	1
10	16 MM COTTER PIN	M.S. GALVANIZED	2
11.	SPLIT PIN	BRASS	2
12	SECURITY CLIP	P.M. BRONZE	1

RURAL ELECTRIFICATION SCHEME		
ASSEMBLY OF TENSION HARDWARE SET		
DRN. AND DATE 31.8.85	DRG. No.	SK5
DES. SCALE N.T.S.	9-1-0-0059	
CHK. DIM. IN		
APP'D.		

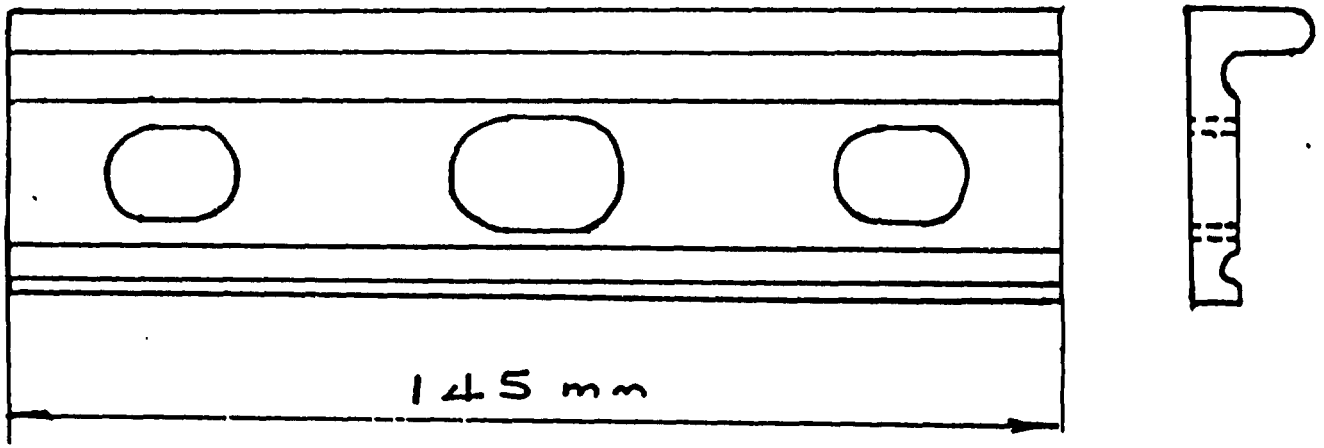
NEW ITEM

Vire Clamps Item 502

Part B

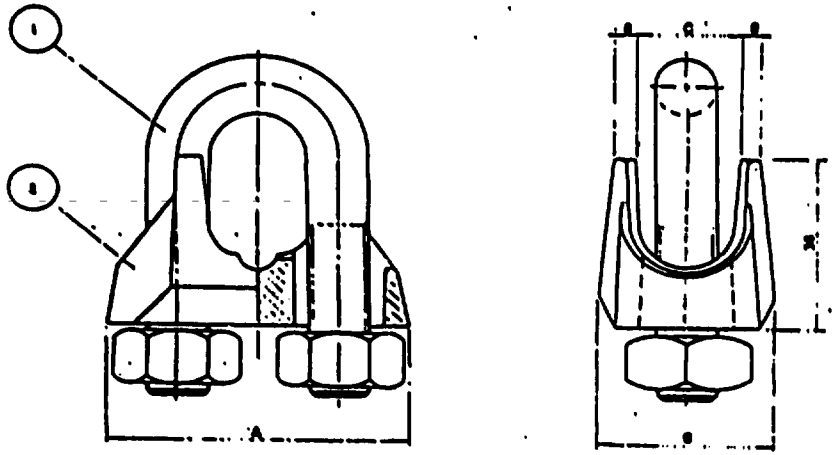


Part A



Full Size
22.4.89

New Item



	D	A	B	C	
7/4.00㎜	16㎜	60	35	22	(6)
10/5.50㎜	3/8"	78	43	30	(8)

NO.	NAMES	Q'TY	REMARK
2	CLAMP		
1	U-BOLT & NUT		

MATERIAL LIST

SCALE N/S	UNIT m/m
GENERAL TOLERANCE ±3%	
MATERIAL BODY: MALLEABLE U-BOLT: S341	
SURFACE TREATMENT HOT-DIP ...	

CUSTOMER

TITLE

BULL DOG CLAMP

DRAWING BY	
CHECKED BY	
CHIEF ENGINEER	
DATE	
DRAWING NO.	

NEW ITEM ITEM 503

GALVANISED MALLEABLE IRON HOSE COUPLINGS

Items 504 to 518

Casting	1 1/4"		1 1/2"		2"		2 1/2"		3"	
	A MM	B MM	A MM	B MM	A MM	B MM	A MM	B MM	A MM	B MM
But	13	38	20	44	25	52	26	90	26	96
	0.11 kg		0.12 kg		0.22 kg		0.48 kg		0.66 kg	
Shank.M	51	33	64	40	64	48	100	85	125	89
	0.25 kg		0.42 kg		0.60 kg		1.08 kg		1.44 kg	
Shank.F	38	31	45	38	51	46	76	79	96	83
	0.19 kg		0.30 kg		0.37 kg		0.54 kg		0.78 kg	

Weights are approximate machined weights .

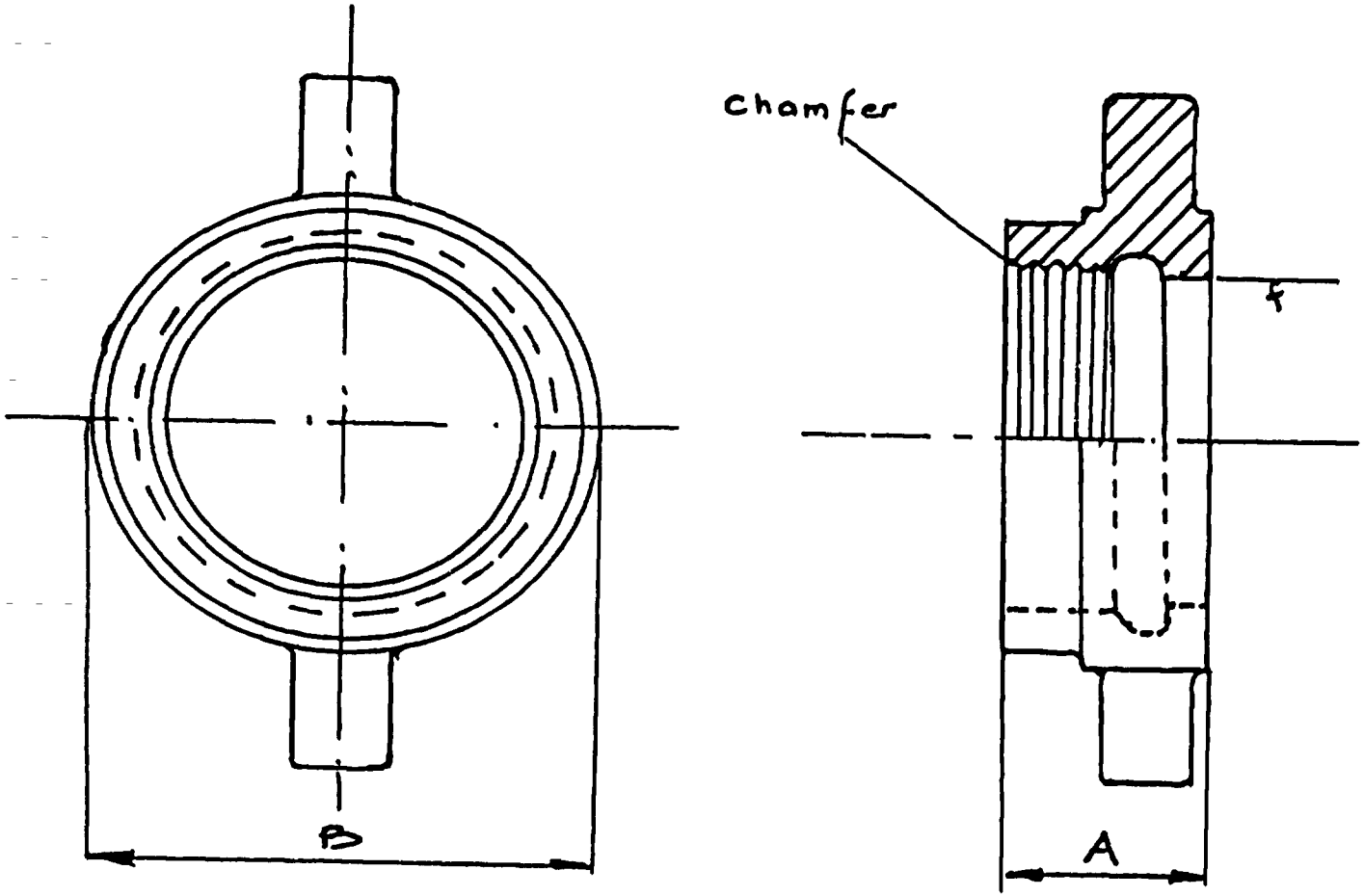
Dimensions are approximate

NB. But has internal recess for rubber seal and must be cord.

But and male shank are threaded and capacity for threading

must be included in pipe fittings machine shop .

HOSE COUPLING NUT

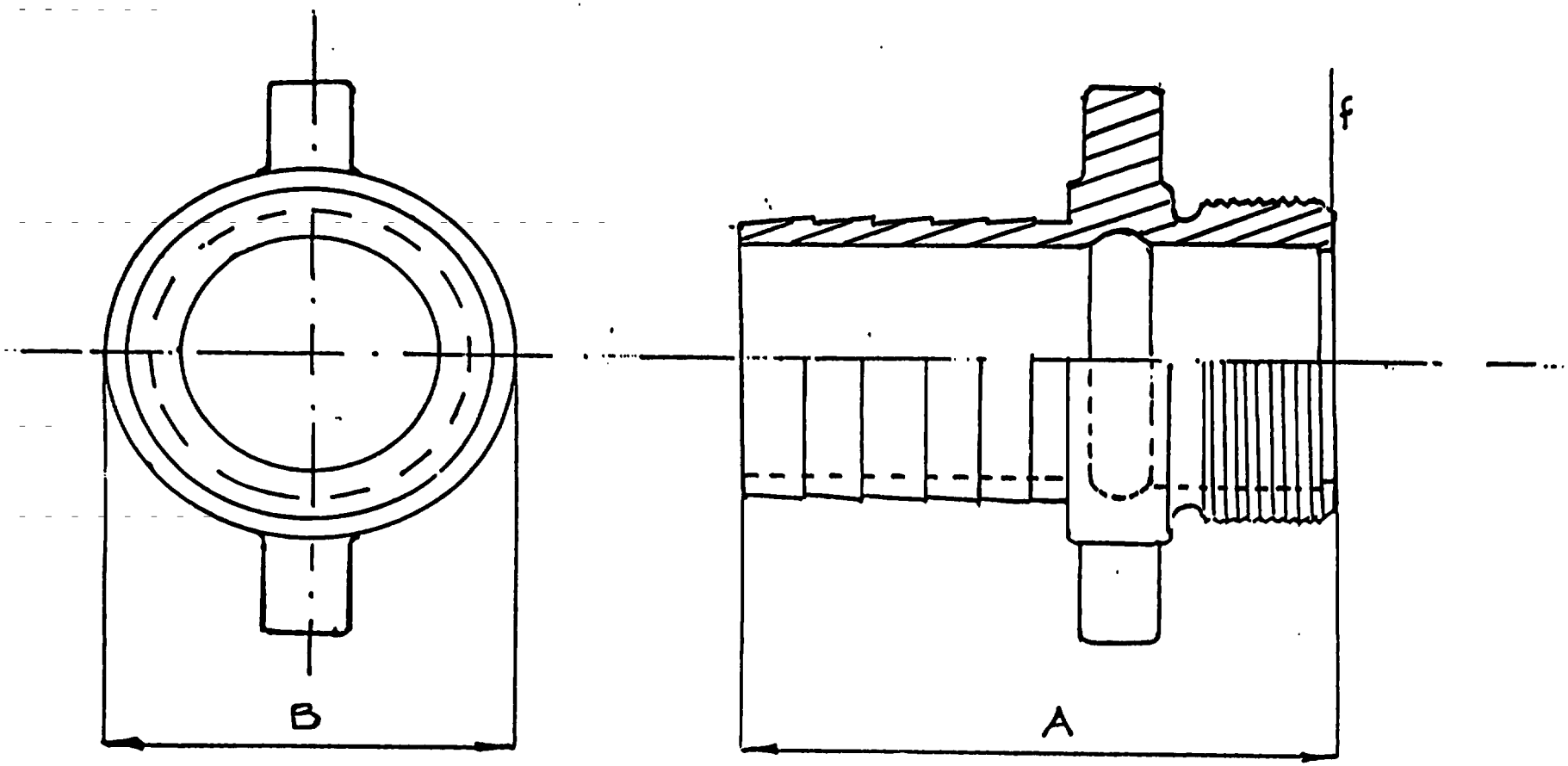


ITEM N°' 504. 507. 510. 513. 516

NEW ITEM

17.4.89

HOSE COUPLING SHANK M

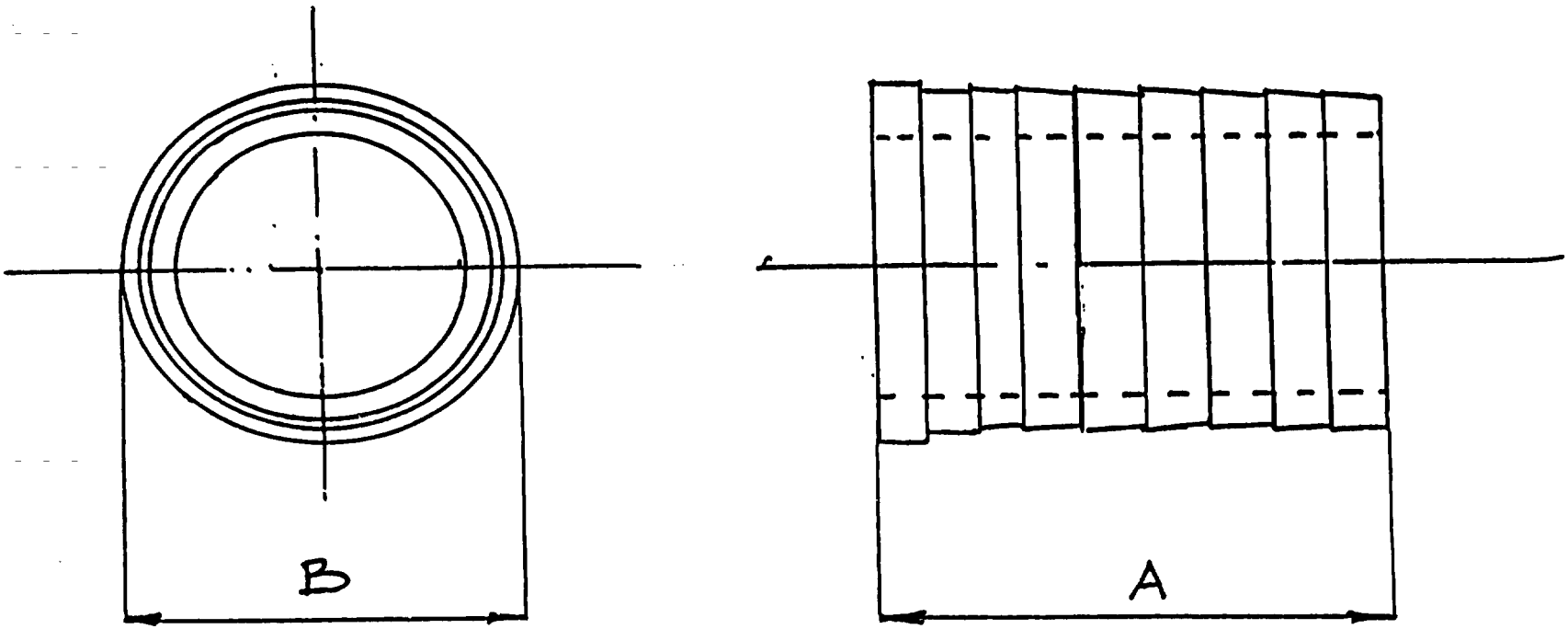


ITEMS N° 505. 508. 511. 514. 517

NEW ITEM

17.4.89

HOSE COUPLING SHANK F.



ITEMS N° 506. 509. 512. 515. 518

NEW ITEM

17.4.89

1.1.2 Program Mix "Steel Castings"

a) Manganese Steel Castings

Item No.	Description	Grade	Pieces per year net	Unit weight kg	Annual weight net t
1.1	Track Pad (chain links)	Mang. Steel	40,000	7	283.2
1.2	" " " "	" "	3,000	10	30.0
1.3	" " " "	" "	1,500	10	15.0
1.4	" " " "	" "	12,000	15	180.0
1.5	" " " "	" "	15,000	15	226.0
1.6	" " " "	" "	2,000	15	30.0
		Subtotal	73,500		764.2

b) Excavator Castings Civil Sector

Item No.	Description		Grade	Pieces per year net	Unit weight kg	Annual weight net t
2.1	Shoe	560x300x100	Carbon and Alloy Steel	4,375	32 av.	140
2.2	Link	300x120x45	"	11,250	8 av.	90
2.3		345x160x70				
2.4	Sprocket	195x90x120	"	984	6.1) 6)	12
2.5		345x115x135		461	13) 6)	
2.6	End Bit	330x240x30	"	937	16) 15)	30
2.7		620x370x40		217	69) 15)	
2.8	Tooth	200x85x80	"	5,333	3.75) 20)	40
2.9		440x150x90		1,333	15) 20)	
2.10	Adaptor	355x140x85	"	77	13	1
			Subtotal	24,967		313

c) Manganese Jaw and Crusher Casting

Item No.	Description		Grade	Pieces per year net	Unit weight kg	Annual weight net t
3.1	Hammers (Crushing)	200x90x32)	16/18 Mn. Steel	6,000	3.5	21
3.2		235x90x32)		82,750	4	331
3.3		270x120x60)		41,333	13.5	558
3.4	Hammers (Cement)	470x340x200	16/18 Mn Steel	734	90	66
3.5	Jaws	400x800x100	Mang. Steel Alloy	600	200	132
3.6	(Stone Crushing)	600x800x100	Mang. Steel Alloy	1,388	330	458
3.7		620x850x150	-dto-	20	550	11
			Subtotal	132,825		1,577

Appendix 4 — MALLEABLE IRON CASTINGS — AEICO

Sheet 1 of 6 — (MOULDING LINE 2) — April 1989

1	2	3	4	5	6	7	8	9
Item No.	Description	Pieces Per Year Net	Unit Weight Kg	Annual Weight Net t	Pieces Per Year Gross	Annual Weight Gross t	No. Per Plate	Moulds Per Year
	Malleable cast iron pipe fittings according to ISO R 49 and DIN 2950							
1	Elbow A1 - 90 - 1/2"	4800000.000	0.091	436.800	5275200.000	563.472	40.000	131880.000
2	dito 3/4"	1420000.000	0.137	194.540	1560580.000	250.957	32.000	48768.125
3	dito 1"	600000.000	0.209	125.400	659400.000	161.766	18.000	36633.333
4	dito 1 1/4"	240000.000	0.332	79.680	263760.000	102.787	16.000	16485.000
5	dito 1 1/2"	120000.000	0.427	51.240	131880.000	66.100	12.000	10990.000
6	dito 2"	240000.000	0.652	156.480	263760.000	201.859	8.000	32970.000
7	Elbow A4 - 92 - 1/2"	480000.000	0.094	45.120	527520.000	58.205	40.000	13188.000
8	dito 3/4"	240000.000	0.145	34.800	263760.000	44.892	32.000	8242.500
9	dito 1"	240000.000	0.228	54.720	263760.000	70.589	18.000	14653.333
10	Tee B1 - 130 - 1/2"	1680000.000	0.130	218.400	1846320.000	281.736	40.000	46158.000
11	dito 3/4"	480000.000	0.187	89.760	527520.000	115.790	32.000	16485.000
12	dito 1"	190000.000	0.282	53.580	208810.000	69.118	18.000	11600.556
	Sub-total	10730000.000		1540.520	11792270.000	1987.271		388053.847

N.B. All unit weights are finished fittings,

i.e after machining

MALLEABLE IRON CASTINGS

(MOULDING LINE 2)

AEICO

April 1989

1	2	3	4	5	6	7	8	9
Item No.	Description	Pieces PER Year Net	Unit Weight Kg	Annual Weight Net t	Pieces Per Year Gross	Annual Weight Gross t	No. Per Plate	Moulds Per Year
13	Tee B1 - 130 - 1 1/4"	190000.000	0.435	82.650	208810.000	106.619	12.000	17400.833
14	dito 1 1/2"	160000.000	0.570	91.200	175840.000	117.648	8.000	21980.000
15	dito 2"	160000.000	0.880	140.800	175840.000	181.632	6.000	29306.667
16	Long sweep bend G1-2 1/2"	360000.000	0.000	0.000	395640.000	0.000	24.000	16485.000
17	dito 3/4"	480000.000	0.246	118.080	527520.000	152.323	24.000	21980.000
18	dito 1"	360000.000	0.399	143.640	395640.000	185.296	15.000	26376.000
19	dito 1 1/4"	240000.000	0.642	154.080	263760.000	198.763	6.000	43960.000
20	dito 1 1/2"	140000.000	0.881	123.340	153860.000	159.109	4.000	38465.000
21	dito 2"	96000.000	1.480	142.080	105504.000	183.283	4.000	26376.000
22	Union taper seat U11 - 340 - 1/2"			0.000	0.000	0.000		
	380	480000.000	0.210	100.800	527520.000	130.032	30.000	17584.000
	(3 Parts) 381	480000.000	0.000	0.000	527520.000	0.000	50.000	10550.400
	374	480000.000	0.000	0.000	527520.000	0.000	48.000	10990.000
	Sub-total	3626000.000		1096.670	3984974.000	1414.704		281453.900

MALLEABLE IRON CASTINGS

(MOULDING LINE 2)

AEICO

April 1989

1	2		3	4	5	6	7	8	9
Item No.	Description		Pieces Per Year Net	Unit Weight Kg	Annual Weight Net t	Pieces Per Year Gross	Annual Weight Gross t	No. Per Plate	Moulds Per Year
23	Union tsper seat U11 - 340 - 3/4"								
		380	160000.000	0.271	43.360	175840.000	55.934	30.000	5861.333
	(3 parts)	381	160000.000	0.000	0.000	175840.000	0.000	56.000	3140.000
		374	160000.000	0.000	0.000	175840.000	0.000	48.000	3663.333
24	dito	1"							
		380	240000.000	0.351	84.240	263760.000	108.670	30.000	8792.000
	(3 Parts)	381	240000.000	0.000	0.000	263760.000	0.000	56.000	4710.000
		374	240000.000	0.000	0.000	263760.000	0.000	48.000	5495.000
25	dito	1 1/4"							
		380	120000.000	0.601	72.120	131880.000	93.035	30.000	4396.000
	(3 parts)	381	120000.000	0.000	0.000	131880.000	0.000	42.000	3140.000
		374	120000.000	0.000	0.000	131880.000	0.000	30.000	4396.000
26	dito	1 1/2"							
		380	96000.000	0.735	70.560	105504.000	91.022	24.000	4396.000
	(3 parts)	381	96000.000	0.000	0.000	105504.000	0.000	24.000	4396.000
		374	96000.000	0.000	0.000	105504.000	0.000	24.000	4396.000
27	dito	2"							
		380	96000.000	1.150	110.400	105504.000	142.416	20.000	5275.200
	(3 parts)	381	96000.000	0.000	0.000	105504.000	0.000	20.000	5275.200
		374	96000.000	0.000	0.000	105504.000	0.000	20.000	5275.200

Sheet 4 of 6

MALLEABLE IRON CASTINGS

(Moulding Line 2)

AEICO

April 1989

Item No.	Description	Pieces Per Year Net	Unit Weight Kg	Annual Weight Net t	Pieces Per Year Gross	Annual Weight Gross t	No. Per Plate	Moulds Per Year
28	Socket M2 - 270 - 1/2"	960000.000	0.061	58.560	1055040.000	75.542	42.000	25120.000
29	dito 3/4"	470000.000	0.093	43.710	516530.000	56.386	42.000	12298.333
30	dito 1"	310000.000	0.133	41.230	340690.000	53.187	35.000	9734.000
31	dito 1 1/4"	135000.000	0.208	28.080	148365.000	36.223	35.000	4239.000
32	dito 1 1/2"	70000.000	0.268	18.760	76930.000	24.200	24.000	3205.417
33	dito 2"	150000.000	0.441	66.150	164850.000	85.334	16.000	10303.125
34	dito 2 1/2"	10000.000	0.735	7.350	10990.000	9.482	12.000	915.833
35	dito 3"	6000.000	1.030	6.180	6594.000	7.972	8.000	824.250
36	Hexagon nipple N8 - 280 - 1/2"	1440000.000	0.060	86.400	1582560.000	111.456	54.000	29306.667
37	dito 3/4"	700000.000	0.087	60.900	769300.000	78.561	54.000	14246.296
38	dito 1"	460000.000	0.140	64.400	505540.000	83.076	40.000	12638.500
39	dito 1 1/4"	350000.000	0.223	78.050	384650.000	100.685	30.000	12821.667
40	dito 1 1/2"	220000.000	0.264	58.080	241780.000	74.923	24.000	10074.167
41	dito 2"	200000.000	0.403	80.600	219800.000	103.974	16.000	13737.500
	Sub-total	5481000.000		698.450	6023619.000	901.001		159464.755

Sheet 5 of 6

MALLEABLE IRON CASTINGS

(MOULDING LINE 2)

AEICO

April 1989

1	2	3	4	5	6	7	8	9
Item No.	Description	Pieces Per Year Net	Unit Weight Kg	Annual Weight Net t	Pieces Per Year Gross	Annual Weight Gross t	No. Per Plate	Moulds Per Year
42	Plug T9 - 290 - 1/2"	1550000.000	0.038	58.900	1703450.000	75.981	90.000	18927.222
43	dito - 1"	300000.000	0.106	31.800	329700.000	41.022	70.000	4710.000
44	Reducing elbow A1 - 90 - 3/4" x 1/2"	220000.000	0.119	26.180	241780.000	33.772	32.000	7555.625
45	Reducing tee B1 - 130 - 3/4" x 1/2"	500000.000	0.162	81.000	549500.000	104.490	32.000	17171.875
46	dito - 1" x 3/4"	250000.000	0.242	60.500	274750.000	78.045	18.000	15263.889
47	dito - 1" x 1/2"	200000.000	0.226	45.200	219800.000	58.308	18.000	12211.111
48	dito - 1 1/4" x 1"	130000.000	0.368	47.840	142870.000	61.714	12.000	11905.833
49	dito - 1 1/4" x 3/4"	45000.000	0.323	14.535	49455.000	18.750	12.000	4121.250
50	dito - 1 1/4" x 1/2"	130000.000	0.310	40.300	142870.000	51.987	12.000	11905.833
51	dito - 1 1/2" x 1 1/4"	150000.000	0.495	74.250	164850.000	95.783	8.000	20606.250
52	dito - 3/4" x 1/2" x 1/2"	220000.000	0.149	32.780	241780.000	42.286	32.000	7555.625
53	dito - 1" x 3/4" x 3/4"	100000.000	0.223	22.300	109900.000	28.767	18.000	6105.556
54	dito - 1" x 1/2" x 3/4"	100000.000	0.204	20.400	109900.000	26.316	18.000	6105.556
55	dito - 1 1/4" x 3/4" x 1"	270000.000	0.290	78.300	296730.000	101.007	12.000	24727.500
	Sub-total	4165000.000		634.285	4577335.000	818.228		168873.125

N.B. Method of specifying sequence of outlets on tees is ISO49 "a"

MALLEABLE IRON CASTINGS

(MOULDING LINE 2)

AEICO

April 1989

1	2	3	4	5	6	7	8	9
Item No.	Description	Pieces Per Year Net	Unit Weight Kg	Annual Weight Net t	Pieces Per Year Gross	Annual Weight Gross t	No.Per Plate	Moulds Per Year
56	Elbow A4-45 - 121 - 1/2"	450000.000	0.078	35.100	494550.000	45.279	42.000	11775.000
57	dito - 3/4"	600000.000	0.122	73.200	659400.000	94.428	32.000	20606.250
58	dito - 1"	450000.000	0.180	81.000	494550.000	104.490	18.000	27475.000
59	dito - 1 1/4"	150000.000	0.290	43.500	164850.000	56.115	12.000	13737.500
60	Bushing N4 - 241 - 3/4" x 1/2"	160000.000	0.047	7.520	175840.000	9.701	54.000	3256.296
61	dito - 1" x 1/2"	220000.000	0.094	20.680	241780.000	26.677	40.000	6044.500
62	dito - 1" x 3/4"	350000.000	0.075	26.250	384650.000	33.863	40.000	9616.250
63	dito - 1 1/4" x 1/2"	70000.000	0.178	12.460	76930.000	16.073	32.000	2404.063
64	dito - 1 1/4" x 3/4"	110000.000	0.160	17.600	120890.000	22.704	32.000	3777.813
65	dito - 1 1/4" x 1"	160000.000	0.120	19.200	175840.000	24.768	24.000	7326.667
66	dito - 1 1/2" x 1/2"	60000.000	0.246	14.760	65940.000	19.040	24.000	2747.500
67	dito - 1 1/2" x 3/4"	60000.000	0.220	13.200	65940.000	17.028	24.000	2747.500
68	dito - 1 1/2" x 1"	160000.000	0.187	29.920	175840.000	38.597	24.000	7326.667
69	dito - 1 1/2" x 1 1/4"	110000.000	0.105	11.550	120890.000	14.900	24.000	5037.083
70	dito - 2" x 1/2"	24000.000	0.348	8.352	26376.000	10.774	16.000	1648.500
71	dito - 2" x 3/4"	24000.000	0.368	8.832	26376.000	11.393	16.000	1648.500
72	dito - 2" x 1"	36000.000	0.400	14.400	39564.000	18.576	16.000	2472.750
73	dito - 2" x 1 1/4"	45000.000	0.346	15.570	49455.000	20.085	16.000	3090.938
74	dito - 2" x 1 1/2"	90000.000	0.273	24.570	98910.000	31.695	16.000	6181.875
	Sub-total	3329000.000		477.664	3658571.000	616.187		138920.650
	GRAND TOTAL	29467000.000		4828.269	32384233.000	6228.467		1209373.544

Appendix 5 Technical Services

Sheet 1 of 8 ==========

1. Scope Of Services :

1.1 General :

The Contractor shall provide operational management, transfer of technology and know-how, and training for operating the foundry (plant) effectively and up to international standards, by providing services including but not limited to the following :-

A. Services during implementation .

B. Services during operation .

C. Services for recruitment and training during operation .

D. Know-How .

1.2 Scope Of Services In Detail :

The purpose of Contractor services is to help AEICO during the implementation phase, as well as responsibilty for production, technology transfer and training during the plant's operation that would enable the foundry project to achieve optimum productivity and effeciency levels .

Operational responsibilty would cover production management, production planning and control, materials management, quality control, maintenance and spare parts management , cost control, production organizational structure, industrial engineering, and safety.

The Contractor shall also assist in the introduction of appropriate management systems and marketing strategies .

The Contractor Scope Of Services will be divided into the following:

A. Services during the implementation of the project :

1. Carrying out the complete planning of the technical management organization and operating system of the foundry so as to equip the plant with all necessary means of production ; and
2. Establishing and implementing a system for the logging of all operating data and the preparation of appropriate summary reports

to management in a timely manner ;

3. Establishing and implementing systems and procedures for efficient product and raw material handling and storing ;
4. Establishing and implementing systems for efficient operation and maintenance ;
5. Preparing plans for implementation of comprehensive preventive maintenance and inspection programs .
6. Developing policies and procedures for dealing with plant modifications; both improvements and remedial works ;
7. Establishing systems and procedures for dealing with unexpected problems (fire, power outage , breakdowns , injuries , operating errors and the like).

B. Services During Operation Stage :

The Contractor will assume full technical management of the foundry plant; in particular they shall provide technical management team as detailed under item 3.2 of the " Remuneration and Terms of Payment " and the following services :-

1. Manage and operate the plant to the maximum attainable level of output but not less than the designed capacity, consistent with safe and efficient operational practices , and coordinate and manage functions of all departments relating to operations in accordance with written procedures proposed by the contractor team and approved by AEICO ;
2. Establish and maintain an appropriate quality control system including tests and recording procedures, to ensure that foundry production will consistently meet quality standards specified ;
3. Maintain , and supervise maintenance of , the plant, equipment and facilities in top working order and in a manner required to acheive full capacity utilization , and establish and carry out an efficient and cost effective maintenance programme in

accordance with equipment records and operating history ;

4. Provide comprehensive safety guidelines that should be followed to protect personnel , equipment and facilities , and to sustain continued safe operation of the plant ;
5. Develop and install documentation on operating instructions , metallic composition and quality control of all products to be manufactured in the plant ;
6. Design, develop and implement appropriate production management systems to monitor and control progress of operations ;
7. Develop and implement appropriate production control procedures designed to maintain high production efficiency and identify operational inefficiencies, including thorough, prompt and accurate measurement and accounting of raw materials utilities and other input consumption ;
8. Assist in identifying and devising an appropriate strategy for sales in the Jordanian market and in the neighbouring countries in keeping with the level of technological sophistication achieved by AEICO from time to time ;
9. Implement plans and programs for on-the-job training of AEICO counterparts and technical staff to allow Jordanian personnel to assume management and operation of the plant as soon as possible but at least one year prior to the completion of this Agreement ;
10. Develop and install an intergrated financial cost control system as appropriate in terms of materials, labor, and overhead inputs systems and thereby provide AEICO with a reliable basis for costing (historical and norm accounting) and operation , planning and control ;
11. Develop and install facilities to perform various industrial engineering functions like work study, organization planning , facilities planning , training, development of procedures and

standards ... etc ;

12. Design, develop and implement an intergrated materials management system to cover all aspect of materials and services , namely, procurement, inventory control, materials logistics and dispatch ... etc ;

13. The Contractor shall assist AEICO in areas not specified above, which contribute to the efficient management of the plant .

C. Services For Recruitment And Training During Operation

1. The Contractor shall provide the following services :

   a. Assist in recruitment of staff to join the AEICO prior to operation;

   b. Prepare training programs to develop competent staff. Such programs to include formal and on-the-job training ;

   c. Execution of training in Jordan .

2. AEICO will appoint counterparts to the Contractor management team who shall provide the counterparts with sufficient training and know-how to enable them to assume directly and efficiently the management of the works as soon as possible but at least one year prior to the completion of this Agreement .

D. Know-How

1. The foundry technology will be transfered from the Contractor's foundries and or the sub-Contractor's foundries and their research facilities to the new foundry of AEICO. The production organization will be based on the technical and practical experience of the Contractor's activities and the training of personnel to be in accordance with Contractor's latest technical and technological standard.

2. The "Know-How" to be supplied by the Contractor shall cover all aspects of the scope of services including, but not limited to , the following :-

a. "Know-How" in regard to production organizational structure, production planning and controlling .

b. "Know-How" in regard to planning and industrial engineering

c. "Know-How" in regard to production and technology relating to grey, ductile, steel and malleable cast iron refering to the preliminary product mix as per appendices 1, 2 and 3 as well as the alloyed types of these irons for engineering castings, automobile parts, special castings and the similar .

3. Contractor undertake to extend the "Know-How" to AEICO in such a way that the new foundry of AEICO will be well-organized on the production management side in general, and production facilities including material, production, quality control and maintenance management as well as in the plant regarding technology from the scrap yard and material melting to the despatch of the product .

4. The "Know-How" shall also cover all pipe fittings and engineering castings which need approximately or exactly the same technology needed under this Agreement .

5. The foundry know-how documentation will be prepared by the contractor in detail and will be handed over to AEICO .

6. The transfer of know-how will be carried out during plant assembly, implementation of production and operation of the plant after implementation. The transfer will be through classroom instructions and on the job .

2. Performance Data

2.1 Foundry Production

The new foundry of AEICO is scheduled to produce 6543 T.P.A.of good quality castings in case of programme 1 in accordance with the product mix appendices 1, 2 and 3 and 7482 T.P.A of good quality casting in case of programme 2 in accordance with product mix appendices 3 and 4 .

2.2 Gradual Increase of Production

After issuing the "Plant Acceptance Certificate" by AEICO to the

Contractor, the new AEICO foundry will gradually increase production under the management and supervision of the Contractor who are fully responsible for achieving the foundry production within four years after giving the "Plant Acceptance Certificate", and according to the following "Foundry Performance Criteria".

Product mix to be devised by AEICO and to be agreed upon by both parties before each build up period .

2.3 Foundry Performance Criteria

Overall foundry performance during build up period (Each period 12 months) .

	Period 1	Period 2	Period 3	Period 4
- Output of castings According to preliminary Product mix, tonne	40%	60%	80%	100%
- Maximum permissible Scrap rate, overall %				
- Minimum permissible Yield rate, overall %				

3. Remuneration and Terms of Payment

The remuneration for the services to be done by the Contractor under this Agreement shall be as follows :-

3.1 General services

A. Services during implementation of the project .

B. Services during operation .

C. Services for recruitment and training during operation

The remuneration for the general services mentioned above will be fixed .

Fixed fees : A lump sum of ---------- .

3.2 Management Team Services On Site

The remuneration of these services is based on a man-month rate. The following is the staff agreed upon for technical management :

Job Title	Nationality	Approximate Period in Months	Monthly Rate	Total
Foundry Manager		36		
Chief Metallurgist		30		
Maintenance Eng.		24		
Methods Eng.		30		
Pattern shop superintendent		30		
Quality Control Eng.		36		
Foundry Supervisor (Moulding & Coremaking)		24		
Foundry Supervisor (Cleaning & Finishing)		24		
Cost Accountant		12		
Max. Totals		246		

Payments will take place upon presentation of monthly invoices certified by AEICO, and in accordance with the above monthly rates. Above mentioned periods and specialities may be modified subject to mutual agreement in writing between both parties.

However the number of total man-months of 246 shall be deemed to be a maximum .

3.3 Know-How

The remuneration for know-how transfer during the execution of this agreement is a fixed lump sum fee of ---------- .